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High resolution trace element and isotopic imaging of microbial systems by NanoSIMS

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The NanoSIMS 50 is the state of the art in high spatial resolution secondary ion mass spectrometry (SIMS), combining unprecedented spatial resolution (as good as 50 nm) with ultra-high sensitivity (minimum detection limit of ~200 atoms). The NanoSIMS has an array of detectors, enabling simultaneous collection of 5 species originating from the same sputtered volume of a sample. The primary ion beam (Cs^+ or O^-) can be scanned across the sample to produce quantitative secondary ion images. This capability provides a novel new approach to the study of microbial systems. We have applied our NanoSIMS to various microbial systems. We have analyzed sub-regions of bacterial cells, biofilms, and other associated materials to map trace element and isotopic ratios on a submicron scale. Growth and metabolism have been tracked using stable isotope labels. High resolution SIMS is particularly powerful when used in combination with other high resolution techniques, such as FIB and TEM. Examples will be presented to demonstrate the range of capabilities of this technique for microbial systems.

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